

WHAT IS CLAIMED IS:

1. A nonaqueous electrolyte, comprising:

a nonaqueous solvent containing ethylene carbonate (EC),  $\gamma$ -butyrolactone (BL), and at least one third solvent selected from the group consisting of ethylene sulfite, phenylethylene carbonate, 2-methylfuran, furan, thiophene, catechol carbonate and vinylethylene carbonate, the EC content falling within a range of 20 to 50% by volume based on the total amount of the EC and the BL, and the BL content falling within a range of 40 to 80% by volume based on the total amount of the EC and the BL; and

a solute dissolved in said nonaqueous solvent.

2. A nonaqueous electrolyte secondary battery, comprising:

a case having a wall thickness not larger than 0.3 mm;

a positive electrode provided in said case;

a negative electrode provided in said case; and

a nonaqueous electrolyte provided in said case and comprising a nonaqueous solvent containing ethylene carbonate (EC) and  $\gamma$ -butyrolactone (BL) and a solute dissolved in said nonaqueous solvent,

wherein, when a charge-discharge cycle test satisfying conditions (A) to (D) given below is performed under an environment of 45°C, the capacity retention rate at 100-th charge-discharge cycle is at

least 85% based on the discharge capacity in the first charge-discharge cycle:

(A) for the charging, the constant current-constant voltage charging to 4.2V is performed for 3 hours under a current of 1C;

(B) the discharging is performed to 3V under a current of 1C;

(C) after the charging, the secondary battery is left to stand for 10 minutes, followed by performing the discharging; and

(D) after the discharging, the secondary battery is left to stand for 10 minutes, followed by performing the charging.

3. The nonaqueous electrolyte secondary battery according to claim 2, wherein said EC is contained in an amount of 20 to 50% by volume based on the total amount of said EC and said BL, and said BL is contained in an amount of 40 to 80% by volume based on the total amount of said EC and said BL.

4. A nonaqueous electrolyte secondary battery, comprising:

a case having a wall thickness not larger than 0.3 mm;

a positive electrode provided in said case;

a negative electrode provided in said case; and

a nonaqueous electrolyte which is provided in said case and comprises a nonaqueous solvent and a solute

dissolved in said nonaqueous solvent, said nonaqueous solvent containing ethylene carbonate (EC),  $\gamma$ -butyrolactone (BL), and at least one third solvent selected from the group consisting of ethylene sulfite, phenylethylene carbonate, 2-methylfuran, furan, thiophene, catechol carbonate and vinylethylene carbonate, the EC content falling within a range of 20 to 50% by volume based on the total amount of the EC and the BL, and the BL content falling within a range of 40 to 80% by volume based on the total amount of the EC and the BL.

5. The nonaqueous electrolyte secondary battery according to claim 4, wherein said nonaqueous electrolyte is substantially in the form of a liquid or a gel.

6. The nonaqueous electrolyte secondary battery according to claim 4, wherein said at least one third solvent is contained in an amount of 5% by weight or less based on the total amount of said nonaqueous solvent.

7. The nonaqueous electrolyte secondary battery according to claim 4, wherein, when said at least one third solvent is formed of at least one solvent selected from the group consisting of phenylethylene carbonate, 2-methylfuran, furan, thiophene, catechol carbonate and vinylethylene carbonate, the mixing amount of said at least one third solvent is not larger

than 3% by weight based on the total amount of said nonaqueous solvent.

8. The nonaqueous electrolyte secondary battery according to claim 4, wherein, when said at least one  
5 third solvent is formed of at least one solvent selected from the group consisting of 2-methylfuran, furan, thiophene, and catechol carbonate, the mixing amount of said at least one third solvent is not larger than 1.5% by weight based on the total amount of said  
10 nonaqueous solvent.

9. The nonaqueous electrolyte secondary battery according to claim 4, wherein, when ethylene sulfite is used as said at least one third solvent, the mixing  
15 amount of said at least one third solvent is not larger than 2% by weight based on the total amount of said nonaqueous solvent.

10. The nonaqueous electrolyte secondary battery according to claim 4, wherein said at least one third solvent is formed of at least one solvent selected from  
20 the group consisting of ethylene sulfite, phenylethylene carbonate, catechol carbonate and vinyl ethylene carbonate.

11. The nonaqueous electrolyte secondary battery according to claim 4, wherein said solute includes at  
25 least one lithium salt selected from the group consisting of  $\text{LiClO}_4$ ,  $\text{LiPF}_6$ ,  $\text{LiBF}_4$ ,  $\text{LiAsF}_6$ ,  $\text{LiCF}_3\text{SO}_3$ ,  $\text{LiN}(\text{CF}_3\text{SO}_2)_2$  and  $\text{LiN}(\text{C}_2\text{F}_5\text{SO}_2)_2$ .

12. The nonaqueous electrolyte secondary battery according to claim 4, wherein said negative electrode contains a carbonaceous material capable of absorbing-desorbing lithium ions.

5        13. The nonaqueous electrolyte secondary battery according to claim 12, wherein said carbonaceous material includes mesophase pitch based carbon fiber.

10        14. The nonaqueous electrolyte secondary battery according to claim 4, wherein said case is formed essentially of a metal plate, a metal film or a sheet including a resin layer.

15        15. A nonaqueous electrolyte secondary battery, comprising:

15            a case having a wall thickness not larger than 0.3 mm;

          a positive electrode provided in said case;

          a negative electrode provided in said case; and

20            a nonaqueous electrolyte layer which is arranged between said positive electrode and said negative electrode and comprises a nonaqueous electrolyte and a polymer for gelling said nonaqueous electrolyte, said nonaqueous electrolyte comprising a nonaqueous solvent containing ethylene carbonate (EC),  $\gamma$ -butyrolactone (BL), and at least one third solvent selected from the group consisting of ethylene sulfite, phenylethylene carbonate, 2-methylfuran, furan, thiophene, catechol carbonate and vinyl ethylene carbonate, the EC content

falling within a range of 20 to 50% by volume based on the total amount of the EC and the BL, and the BL content falling within a range of 40 to 80% by volume based on the total amount of the EC and the BL.

5           16. The nonaqueous electrolyte secondary battery according to claim 15, wherein the mixing amount of said third solvent is not larger than 5% by weight based on the total amount of said nonaqueous solvent.

10           17. The nonaqueous electrolyte secondary battery according to claim 15, wherein, when said at least one third solvent is formed of at least one solvent selected from the group consisting of phenylethylene carbonate, 2-methylfuran, furan, thiophene, catechol carbonate and vinyl ethylene carbonate, the mixing  
15           amount of said at least one third solvent is not larger than 3% by weight based on the total amount of said nonaqueous solvent.

20           18. The nonaqueous electrolyte secondary battery according to claim 15, wherein, when said at least one third solvent is formed of at least one solvent selected from the group consisting of 2-methylfuran, furan, thiophene, and catechol carbonate, the mixing  
25           amount of said at least one third solvent is not larger than 1.5% by weight based on the total amount of said nonaqueous solvent.

          19. The nonaqueous electrolyte secondary battery according to claim 15, wherein, when ethylene sulfite

is used as said at least one third solvent, the mixing amount of said at least one third solvent is not larger than 2% by weight based on the total amount of said nonaqueous solvent.

5           20. The nonaqueous electrolyte secondary battery  
according to claim 15, wherein said at least one third  
solvent is formed of at least one solvent selected from  
the group consisting of ethylene sulfite, catechol  
carbonate, vinyl ethylene carbonate and phenylethylene  
carbonate.  
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